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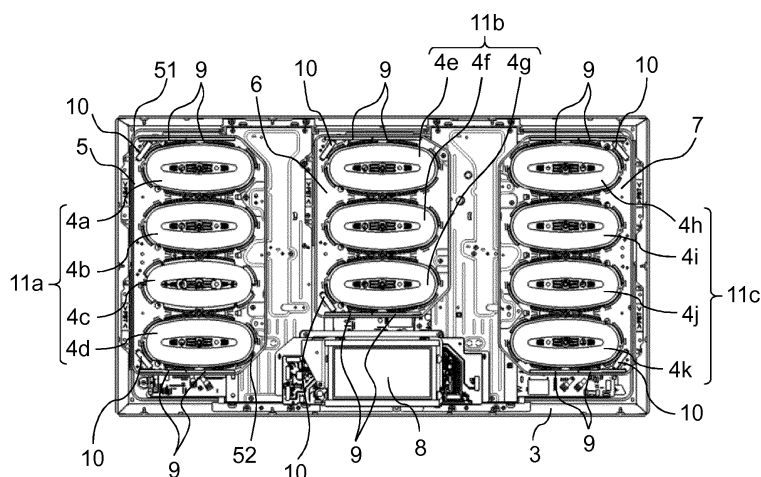
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(54) **INDUCTION HEATING COOKING DEVICE**

(57) An induction heating cooker includes outer shell (3) having an opening portions in its upper portion, a top plate configured to cover the opening portion and to place a to-be-heated object thereon, and a plurality of heating coil units for performing induction heating on the to-be-heated object. The heating coil units are placed

closely to each other. A second ferrite is placed in the opposite side with respect to heating coil unit (4a) placed at an end, from heating coil unit (4b) adjacent thereto, and between outer shell (3) and heating coil unit (4a) placed at the end.

FIG. 2



Description

TECHNICAL FIELD

[0001] The present invention relates to induction heating cookers for use in ordinary homes and businesses.

BACKGROUND ART

[0002] Conventionally, induction heating cookers have had heating coil units including ferrites, which are placed under top plates. Generally, induction heating cookers are configured to heat a single to-be-heated object, with a single heating coil unit. However, in recent years, there have been suggested induction heating cookers having multi-coil structures for heating a single to-be-heated object with a plurality of heating coil units (for example, PTL 1).

[0003] However, in induction heating cookers having conventional multi-coil structures, heating coil units are placed closely to each other and, therefore, in the heating coil units adjacent to each other, magnetic fluxes generated therefrom are influenced by the ferrite cores in the heating coil units adjacent thereto. Further, in the heating coil units placed at the ends, magnetic fluxes are not spread in a substantially-concentric shape from the heating coil units, thereby inducing deflections therein. This inhibits magnetic fluxes from concentrating in a to-be-heated object such as a pan, thereby inducing the problem of increases of electromagnetic wave leakages and radiant noises.

Citation List

Patent Literature

[0004] PTL 1: Unexamined Japanese Patent Publication No. 2014-044823

SUMMARY OF THE INVENTION

[0005] The present invention was made in view of conventional problems as described above and aims at providing an induction heating cooker with excellent reliability which has a multi-coil structure including a plurality of heating coils and is capable of suppressing electromagnetic wave leakages and radiant noises.

[0006] More specifically, in an example of an exemplary embodiment of the present invention, there is provided an induction heating cooker including an outer shell having an opening portion in an upper portion of the outer shell, a top plate configured to cover the opening portion and on which an object to be heated is placed, and a plurality of heating coil units provided under the top plate inside the outer shell and configured to heat the object to be heated. A first ferrite is provided under each of the plurality of heating coil units, and the heating coil units are placed closely to each other. Further, the heating coil

units include a heating coil unit placed at an end, and a heating coil unit adjacent to the heating coil unit placed at the end. A second ferrite is provided adjacently to the heating coil unit placed at the end, among the plurality of heating coil units. The second ferrite is placed in an opposite side with respect to the heating coil unit placed at the end, from the heating coil unit adjacent thereto in an inner side, and between the outer shell and the heating coil unit placed at the end.

[0007] With this structure, even when a to-be-heated object such as a pan is heated with the heating coil unit placed at the end, it is possible to suppress deflections of magnetic fluxes, thereby causing magnetic fluxes to spread substantially in a concentric shape, so that magnetic fluxes are liable to concentrate in the to-be-heated object. This can suppress leakages of electromagnetic waves and radiant noises.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1 is an exploded perspective view of an induction heating cooker according to a first exemplary embodiment of the present invention.

FIG. 2 is a plan view illustrating a state where a top plate has been removed, according to the first exemplary embodiment of the present invention.

FIG. 3 is an exploded perspective view of heating coil units in the induction heating cooker according to the first exemplary embodiment of the present invention.

FIG. 4 is a cross-sectional view of main portions of the induction heating cooker, illustrating flows of magnetic lines of forces in the induction heating cooker illustrated in FIG. 1.

FIG. 5 is a plan view illustrating a state where a top plate has been removed, according to a second exemplary embodiment of the present invention.

FIG. 6 is a plan view illustrating a state where a top plate has been removed, according to a third exemplary embodiment of the present invention.

FIG. 7 is a cross-sectional view of main portions of a conventional induction heating cooker, illustrating flows of magnetic lines of forces in conventional heating coil units, which corresponds to the induction heating cooker illustrated in FIG. 4 from which second ferrites and third ferrites are removed.

DESCRIPTION OF EMBODIMENTS

[0009] Hereinafter, the present invention will be described, with reference to the drawings. Further, the present invention is not intended to be restricted by the exemplary embodiments which will be described later.

(First Exemplary Embodiment)

[0010] FIG. 1 is an exploded perspective view of an induction heating cooker according to a first exemplary embodiment of the present invention. FIG. 2 is a plan view illustrating a state where a top plate has been removed, according to the first exemplary embodiment of the present invention. FIG. 3 is an exploded perspective view of heating coil units in the induction heating cooker according to the first exemplary embodiment of the present invention. Further, FIG. 4 is a cross-sectional view of main portions of the induction heating cooker, illustrating flows of magnetic lines of forces in the induction heating cooker illustrated in FIG. 1. FIG. 7 illustrates a cross-sectional view of main portions of a conventional induction heating cooker, illustrating flows of magnetic lines of forces in conventional heating coil units, which corresponds to the induction heating cooker illustrated in FIG. 4 from which second ferrites and third ferrites are removed.

[0011] Referring to FIG. 1 and FIG. 3, under top plate 2 covering an opening portion in an upper portion of outer shell 3, there are provided various members in induction heating cooker 100 having a multi-coil structure, which is constituted by a plurality of heating coils 4 and the like. Near lower bottom surfaces of respective heating coil units 4, near outer peripheries thereof, and near inner peripheries thereof, there are provided first ferrites 12.

[0012] As illustrated in FIG. 1 and FIG. 2, a plurality of heating coil units 4 are placed in such a way as to be arranged in planar longitudinal and lateral rows, inside outer shell 3. In induction heating cooker 100 according to the present exemplary embodiment, heating coil units 4 have an elliptical shape with a length of about 80 mm in a transverse direction and with a length of about 180 mm in a longitudinal direction. Further, for example, each four or three heating coil units 4, out of heating coil units 4, are secured through an adhesive agent made of silicon and the like, in such a way as to be arranged, closely to each other, on shield boxes 5, 6, 7. In top plate 2, there is an area capable of heating, just above an area in which heating coil units 4 are placed. Even if two or more to-be-heated objects are placed within this area capable of heating, it is possible to perform induction heating thereon.

[0013] Further, in top plate 2, there is placed manipulation display portion 8, in an area outside the area capable of heating, in which heating coil units 4 are placed. Manipulation display portion 8 is constituted by a liquid crystal display portion, and a touch panel overlaid thereon. Manipulation display portion 8 is configured to display manipulation buttons and to display the contents of manipulations and the contents of operations, through light emission, in manipulation display portion 8, when induction heating cooker 100 has been activated.

[0014] Referring to FIG. 2, shield boxes 5, 6, 7 have bottom surfaces having asymmetric polygonal shapes (for example, hexagonal shapes) provided by cutting par-

tial corners from substantially-rectangular shapes, substantially-polygonal shapes having rounded corner portions (with R shapes), and other shapes, in order to be prevented from interfering with other components in induction heating cooker 100. Further, shield boxes 5, 6, 7 are formed to have substantially-box-type shapes (shield boxes) having bottom surfaces, and side walls provided on the bottom surfaces at their outer peripheries. Further, in shield box 5, heating coil units 4a, 4b, 4c, 4d are placed to form coil module 11a. In shield box 6, heating coil units 4e, 4f, 4g are placed to form coil module 11b. In shield box 7, heating coil units 4h, 4i, 4j, 4k are placed to form coil module 11c. Coil module 11a and coil module 11c are placed in a leftwardly/rightwardly inverted manner (bissymmetrically). Further, in respective coil modules 11a, 11b, 11c, respective second ferrites 9 are placed in shield boxes 5, 6, 7 through an adhesive agent made of silicon and the like, at the ends in the longitudinal direction, and, furthermore, third ferrites 10 are selectively placed therein.

[0015] In FIGS. 4 and 7, broken lines indicate magnetic lines of forces 13, 14.

[0016] Hereinafter, there will be described induction heating cooker 100 having the aforementioned structure according to the present exemplary embodiment, regarding operations and effects thereof.

[0017] At first, in coil module 11a, respective heating coil units 4a, 4b, 4c, 4d are placed closely to each other and, therefore, magnetic fluxes generated from respective heating coil units 4a, 4b, 4c, 4d are influenced by first ferrites 12 adjacent thereto. Namely, magnetic fluxes generated from heating coil unit 4a are influenced by first ferrites 12 placed under heating coil unit 4b. Further, magnetic fluxes generated from heating coil unit 4b are influenced by first ferrites 12 placed under heating coil units 4a and 4c.

[0018] For example, when to-be-heated object 1 with a diameter of about 90 mm is heated by heating coil unit 4b, heating coil units 4a, 4c adjacent to heating coil unit 4b are placed evenly in a forward and rearward (longitudinal) direction, and the walls of shield box 5 are placed substantially evenly in a leftward and rightward (lateral) direction, so that magnetic fluxes generated from heating coil unit 4b are evenly spread in a substantially concentric shape.

[0019] However, when to-be-heated object 1 with a diameter of about 90 mm is heated by heating coil unit 4a placed at an end, only heating coil unit 4b is the heating coil unit adjacent to heating coil unit 4a. Further, in the leftward and rightward (lateral) direction, the corner portions of shield box 5 in one side are formed to have oblique walls and, therefore, are at shorter distances from heating coil unit 4a than those of the side walls of the other portions of shield box 5. Therefore, if there is no second ferrite 9, as indicated by the lines of magnetic forces 14 in FIG. 7, a deflection will occur at a portion of magnetic fluxes generated from the heating coil unit, for example, in magnetic fluxes spread toward heating coil

unit 4b in the inner side, which inhibits magnetic fluxes from being concentrated in to-be-heated object 1. Further, if there is no third ferrite 10, the same phenomenon will occur.

[0020] On the other hand, in induction heating cooker 100 according to the present exemplary embodiment, as illustrated in FIG. 4, second ferrites 9 are placed at such positions that these second ferrites 9 and heating coil unit 4b adjacent to heating coil unit 4a placed at the end are symmetric with respect to heating coil unit 4a placed at the end. Further, these second ferrites 9 are placed outside side walls of first ferrites 12 in heating coil unit 4a and, also, between these side walls and outer shell 3.

[0021] Further, as illustrated in FIG. 2 and FIG. 3, third ferrites 10 can be also placed at positions facing the side walls of corner portions of shield box 5. For example, in induction heating cooker 100 according to the present exemplary embodiment, as illustrated in FIG. 2, third ferrite 10 is provided in such a way as to face the side wall of corner portion 51, wherein this third ferrite 10 has such a shape (an oblique shape, more specifically an oblique shape formed by partially cutting a corner of shield box 5 having a substantially-rectangular shape) that the shape of this third ferrite 10 and the oblique shape of the side wall of corner portion 52, which is diagonal to corner portion 51 of shield box 5, are substantially symmetric.

[0022] With this structure, it is possible to suppress deflections of magnetic fluxes as illustrated in the lines of magnetic forces 13 in FIG. 4, which causes magnetic fluxes to spread in a substantially-concentric shape. Therefore, magnetic fluxes are liable to concentrate in to-be-heated object 1, which can suppress leakages of electromagnetic waves and radiant noises, which enables provision of induction heating cooker 100 having excellent reliability.

[0023] According to the present exemplary embodiment, it is also possible to provide the same effects for heating coil units 4d, 4e, 4g, 4h, 4k placed at the ends, as well as for the aforementioned heating coil unit 4a. Further, in cases where to-be-heated object 1 with an outer diameter (diameter) of about 200 mm is heated with two or more heating coil units, for example, with heating coil units 4a and 4b, in cases where to-be-heated object 1 with an outer diameter (diameter) of about 300 mm is heated with two or more heating coil units, for example, with heating coil units 4a, 4b, 4c, and in other cases, similarly, it is possible to provide the same effects. Further, in cases where to-be-heated object 1 covering all of heating coil units 4a, 4b, 4c, 4d is heated, magnetic fluxes are balanced through to-be-heated object 1 and, therefore, the second ferrites do not exert significant effects.

(Second Exemplary Embodiment)

[0024] FIG. 5 is a plan view illustrating induction heating cooker 200 according to a second exemplary embodiment of the present invention, in a state where a top

plate is removed therefrom. Further, induction heating cooker 200 according to the present exemplary embodiment has the same basic structure as that of induction heating cooker 100 according to the first exemplary embodiment and, therefore, will be described mainly regarding differences therefrom. Further, the same elements as those of the first exemplary embodiment will be designated by the same reference characters and will not be described.

[0025] Induction heating cooker 200 illustrated in FIG. 5 is different from induction heating cooker 100 according to the first exemplary embodiment, in that heating coil units 4 have a circular shape with an outer diameter (diameter) of about 65 mm and are placed in such a way as to be arranged in planar longitudinal and lateral rows. This structure has an advantage of having an increased area capable of induction heating and, also, has an advantage of being capable of heating to-be-heated objects with various sizes and shapes with excellent efficiency. In induction heating cooker 200 according to the present exemplary embodiment, similarly, second ferrites 9 are placed at such positions that second ferrites 9 and the inner heating coil units adjacent to the heating coil units placed at the ends, out of a plurality of heating coil units 4, are symmetric with respect to the heating coil units placed at the ends. With this structure, when a to-be-heated object is heated with a heating coil unit at an end, it is possible to suppress deflection of magnetic fluxes due to the first ferrites provided in the inner heating coil unit adjacent to the heating coil unit under the to-be-heated object. Therefore, magnetic fluxes are liable to concentrate in the to-be-heated object, which can suppress leakages of electromagnetic waves and radiant noises. This enables provision of induction heating cooker having excellent reliability.

[0026] Further, in the present exemplary embodiment, there has been described a case where three or more heating coil units are arranged longitudinally and laterally (forwardly and rearwardly, and leftwardly and rightwardly). However, when two heating coil units are arranged longitudinally and laterally, similarly, it is also possible to provide the same effects, by placing second ferrites 9 between the heating coil units and the outer shell 3.

(Third Exemplary Embodiment)

[0027] FIG. 6 is a plan view illustrating induction heating cooker 300 according to a third exemplary embodiment of the present invention, in a state where a top plate is removed therefrom. Further, induction heating cooker 300 according to the present exemplary embodiment has the same basic structure as that of induction heating cooker 100 according to the first exemplary embodiment and, therefore, will be described mainly regarding differences therefrom. Further, the same elements as those of induction heating cooker 100 according to the first exemplary embodiment will be designated by the same reference characters and will not be described.

[0028] Induction heating cooker 300 according to the present embodiment is different from induction heating cooker 100 according to the first exemplary embodiment, in terms of combinations of sizes and shapes of coils. More specifically, as illustrated in FIG. 6, a plurality of heating coil units 4-1, 4-2, 4-3 having different sizes and shapes are placed in such a way as to be arranged closely to each other. Heating coil units 4-1 have a circular shape with an outer diameter (diameter) of about 80 mm, heating coil units 4-2 have an elliptical shape with a size of about 80 mm × about 180 mm, and heating coil units 4-3 have a circular shape with an outer diameter of about 180 mm. Heating coil units 4-2 are about twice the size of heating coil units 4-1. Further, similarly to in induction heating cooker 100 according to the first exemplary embodiment, first ferrites are placed under the respective heating coil units.

[0029] Generally, the first ferrites have respective sizes (volumes) proportional to the sizes of the heating coil units provided with these first ferrites. In induction heating cooker 300 according to the present exemplary embodiment, similarly, the first ferrites under heating coil units 4-2 are about twice the size of the first ferrites under heating coil units 4-1.

[0030] In induction heating cooker 300 according to the present exemplary embodiment, there are further formed second ferrites 9-1, 9-2, in proportion to the sizes of the heating coil units adjacent to the heating coil units placed at the ends. As illustrated in FIG. 6, second ferrites 9-1, 9-2 are placed at such positions that second ferrites 9-1, 9-2 and the heating coil units adjacent to the heating coil units placed at the ends are symmetric with respect to the heating coil units placed at the ends. Further, second ferrites 9-1, 9-2 are placed between outer shell 3 and the heating coil units placed at the ends.

[0031] As illustrated in FIG. 6, second ferrites 9-2 are about twice the size (volume) of second ferrites 9-1. On the other hand, heating coil units 4-2 are about twice the size of heating coil units 4-1, and the first ferrites provided under heating coil units 4-2 are about twice the size of the first ferrites provided under heating coil units 4-1.

[0032] In cases where the heating coil unit adjacent to a heating coil unit (for example, heating coil unit 4-1 in FIG. 6) placed at an end is heating coil unit 4-2, there is formed second ferrite 9-2 which is proportional to the size of this heating coil unit 4-2, at such a position that this second ferrite 9-2 and this heating coil unit 4-2 are symmetric with respect to this heating coil unit 4-1 placed at the end. Further, this second ferrite 9-2 is placed between outer shell 3 and this heating coil unit 4-1 placed at the end.

[0033] Further, in cases where the heating coil unit adjacent to a heating coil unit placed at an end is heating coil unit 4-1, there is placed second ferrite 9-1 which is proportional to the size of this heating coil unit 4-1, at such a position that this second ferrite 9-1 and this heating coil unit 4-1 adjacent to this heating coil unit (for example, heating coil unit 4-3 in FIG. 6) placed at the end

are symmetric with respect to this heating coil unit 4-3 placed at the end. Further, this second ferrite 9-1 is placed between outer shell 3 and this heating coil unit 4-3 placed at the end.

[0034] With this structure, it is possible to suppress deflections of magnetic fluxes due to the first ferrites, which are proportional to the sizes of the heating coil units adjacent to the heating coil units placed at the ends, in inner sides of induction heating cooker 300. This can suppress leakages of electromagnetic waves and radiant noises. This enables provision of an induction heating cooker having excellent reliability.

[0035] As described above, an induction heating cooker in an example of an exemplary embodiment of the present invention includes an outer shell having an opening portion in its upper portion, a top plate configured to cover the opening portion and to place a to-be-heated object thereon, and a plurality of heating coil units for performing induction heating on the to-be-heated object, under the top plate, inside the outer shell. There are provided respective first ferrites under the heating coil units. Further, under the top plate, there are placed the heating coil units closely to each other. The heating coil units include a heating coil unit placed at an end, and a heating coil unit adjacent to the heating coil unit placed at the end. A second ferrite is provided adjacently to the heating coil unit placed at the end. Further, the second ferrite is placed in an opposite side with respect to the heating coil unit placed at the end, from the heating coil unit adjacent to the heating coil unit placed at the end, and between the outer shell and this heating coil unit placed at the end. With this structure, even when a to-be-heated object such as a pan is heated with the heating coil unit placed at the end, it is possible to suppress deflections of magnetic fluxes, thereby causing magnetic fluxes to spread substantially in a concentric shape, so that magnetic fluxes are liable to concentrate in the to-be-heated object. This can suppress leakages of electromagnetic waves and radiant noises.

[0036] The induction heating cooker in an example of an exemplary embodiment of the present invention can further include a shield box configured to place the heating coil units therein. Further, in a corner portion of the shield box, a third ferrite can be placed in such a way as to face a side wall of the corner portion, such that the third ferrite has such a shape that the shape of the third ferrite and the shape of a side wall of the shield box which is diagonal to the corner portion are substantially symmetric. With this structure, it is possible to suppress deflections of magnetic fluxes due to the shape of the shield box, which can suppress leakages of electromagnetic waves and radiant noises.

[0037] In the induction heating cooker in an example of an exemplary embodiment of the present invention, the second ferrite is formed in proportion to the size of the heating coil unit adjacent to the heating coil unit placed at the end. With this structure, it is possible to certainly suppress deflections of magnetic fluxes due to

the sizes of the heating coil units, which can suppress leakages of electromagnetic waves and radiant noises.

[0038] As described above, according to the present invention, even when a to-be-heated object such as a pan is heated with the heating coil unit placed at the end, it is possible to suppress deflections of magnetic fluxes, thereby causing magnetic fluxes to spread substantially in a concentric shape, so that magnetic fluxes are liable to concentrate in the to-be-heated object. This can suppress leakages of electromagnetic waves and radiant noises.

INDUSTRIAL APPLICABILITY

[0039] As described above, according to the present invention, there is provided an induction heating cooker capable of suppressing leakages of electromagnetic waves and radiant noises, no matter which heating coil unit is used, out of a plurality of heating coil units, for heating. Accordingly, the present invention can be widely utilized for induction heating cookers for household uses, business uses and other applications.

REFERENCE MARKS IN THE DRAWINGS

[0040]

- 1: to-be-heated object
- 2: top plate
- 3: outer shell
- 4, 4a, 4b, 4c, 4d, 4e, 4f, 4g, 4h, 4i, 4j, 4k, 4-1, 4-2, 4-3: heating coil unit
- 5, 6, 7: shield box
- 8: manipulation display portion
- 9, 9-1, 9-2: second ferrite
- 10: third ferrite
- 11a, 11b, 11c: coil module
- 12: first ferrite
- 13, 14: magnetic lines of forces
- 51, 52: corner portion

other and include a heating coil unit placed at an end, and a heating coil unit adjacent to the heating coil unit placed at the end, a second ferrite is provided adjacently to the heating coil unit placed at the end, and the second ferrite is placed in an opposite side with respect to the heating coil unit placed at the end, from the heating coil unit adjacent to the heating coil unit placed at the end, and between the outer shell and the heating coil unit placed at the end.

2. The induction heating cooker according to claim 1, further comprising:

a shield box in which the plurality of heating coil units are placed, wherein in a corner portion of the shield box, a third ferrite having is placed in such a way as to face a side wall of the corner portion, wherein the third ferrite has a shape which is substantially symmetrical with respect to a shape of a side wall of the shield box located at a position diagonal to the corner portion.

3. The induction heating cooker according to claim 1 or 2, wherein the second ferrite is formed in proportion to a size of the heating coil unit adjacent to the heating coil unit placed at the end.

Claims

1. An induction heating cooker comprising:
 - an outer shell having an opening portion in an upper portion of the outer shell;
 - a top plate configured to cover the opening portion and on which an object to be heated is placed; and
 - a plurality of heating coil units provided under the top plate inside the outer shell and configured to heat the object to be heated;
 - wherein
 - a first ferrite is provided under each of the plurality of heating coil units,
 - the heating coil units are placed closely to each

FIG. 1

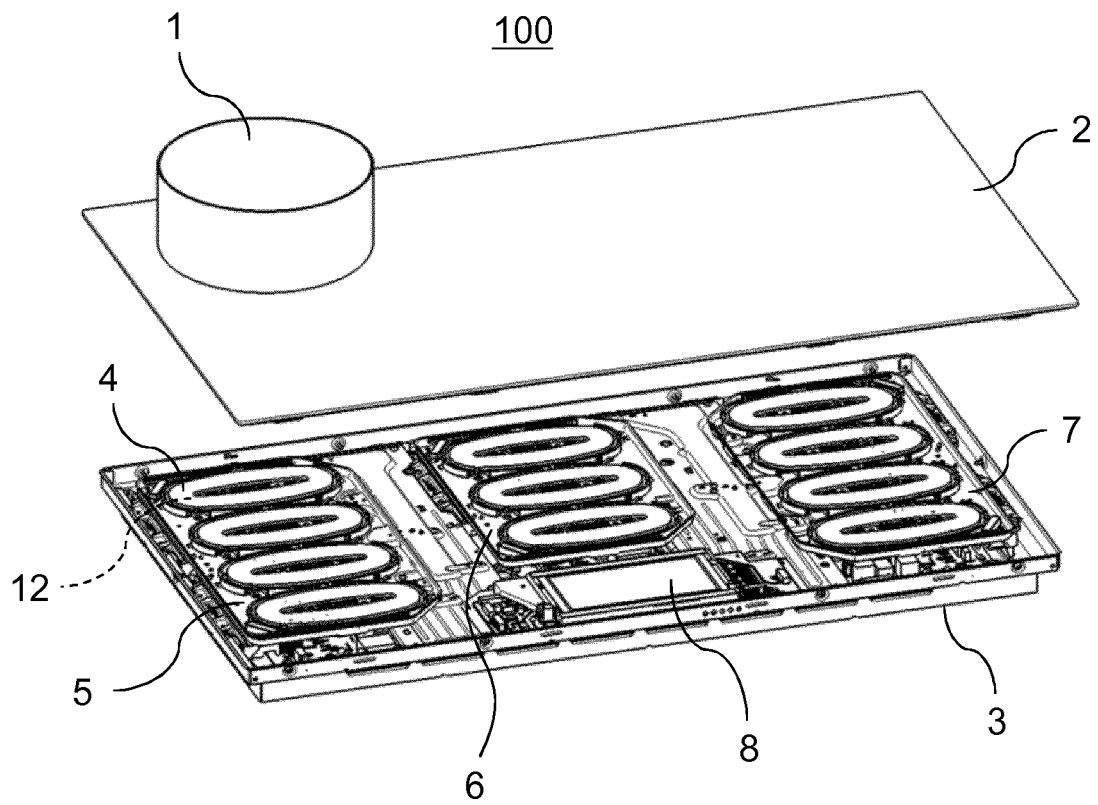


FIG. 2

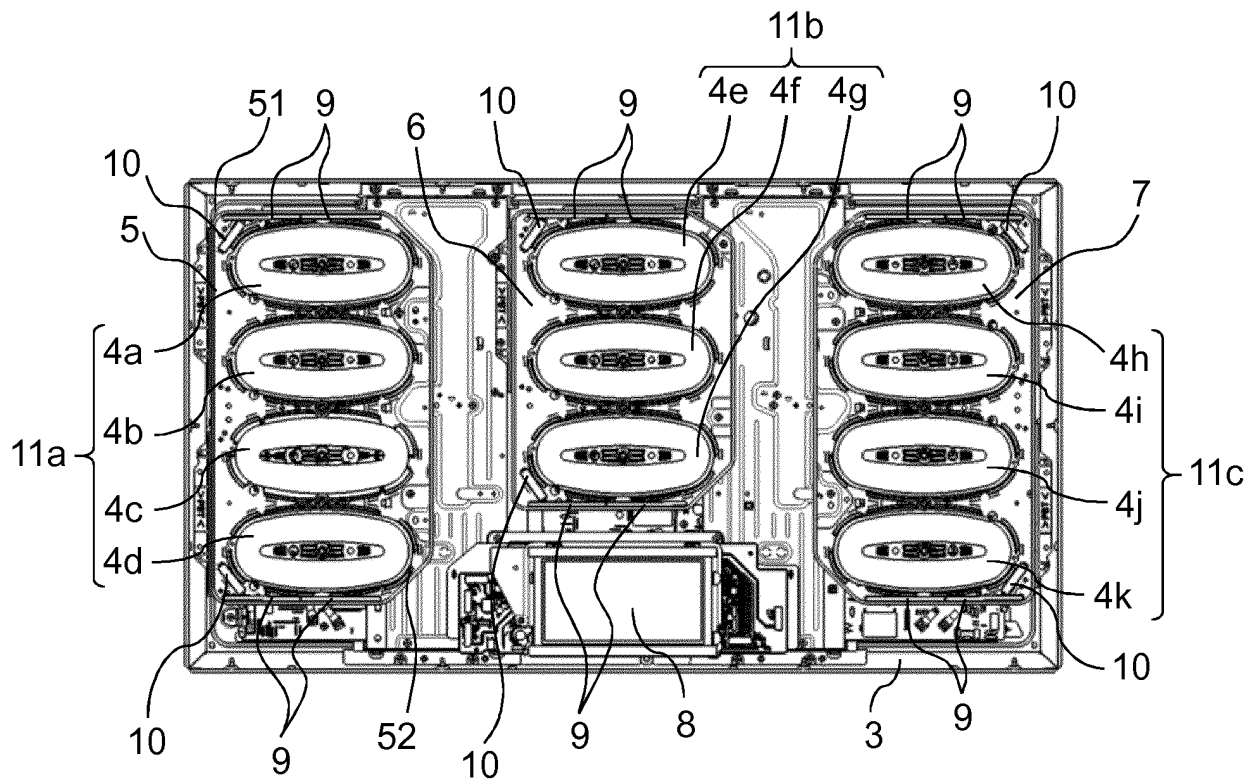


FIG. 3

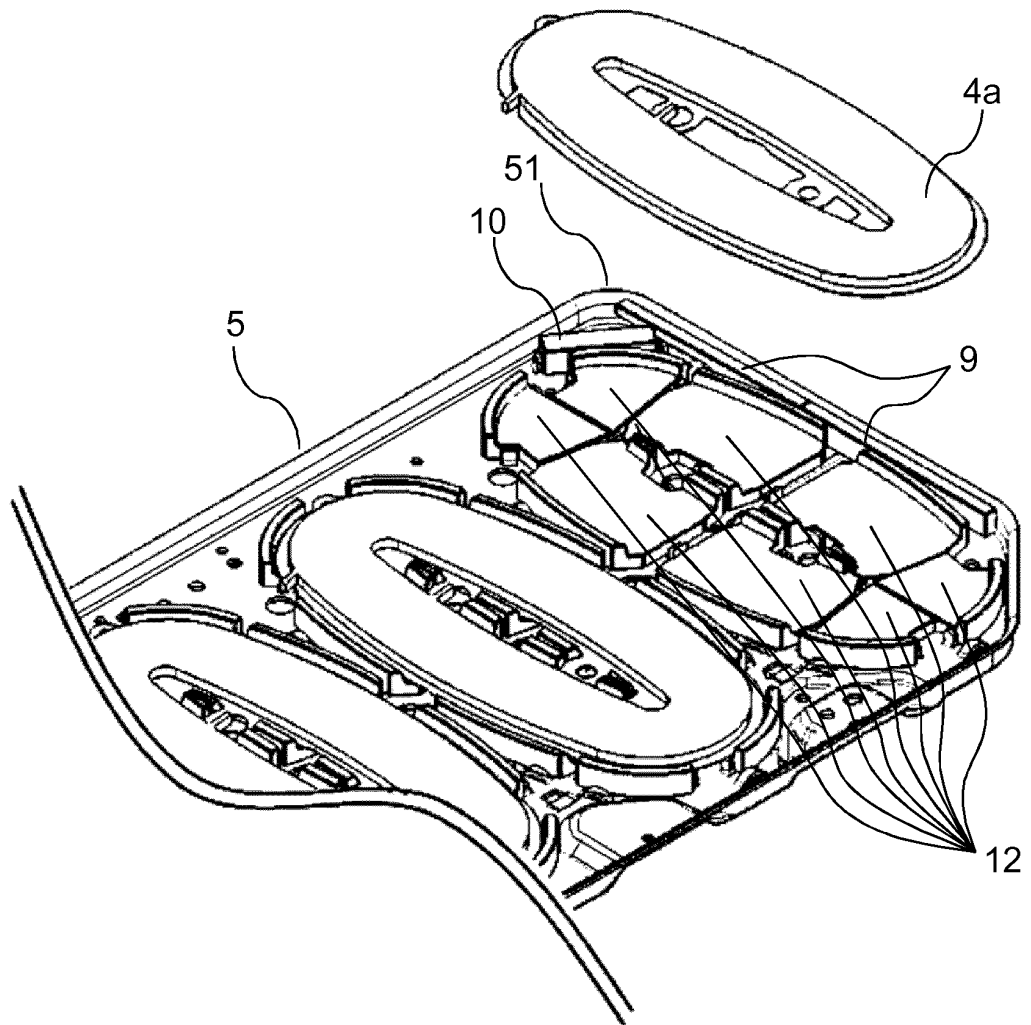


FIG. 4

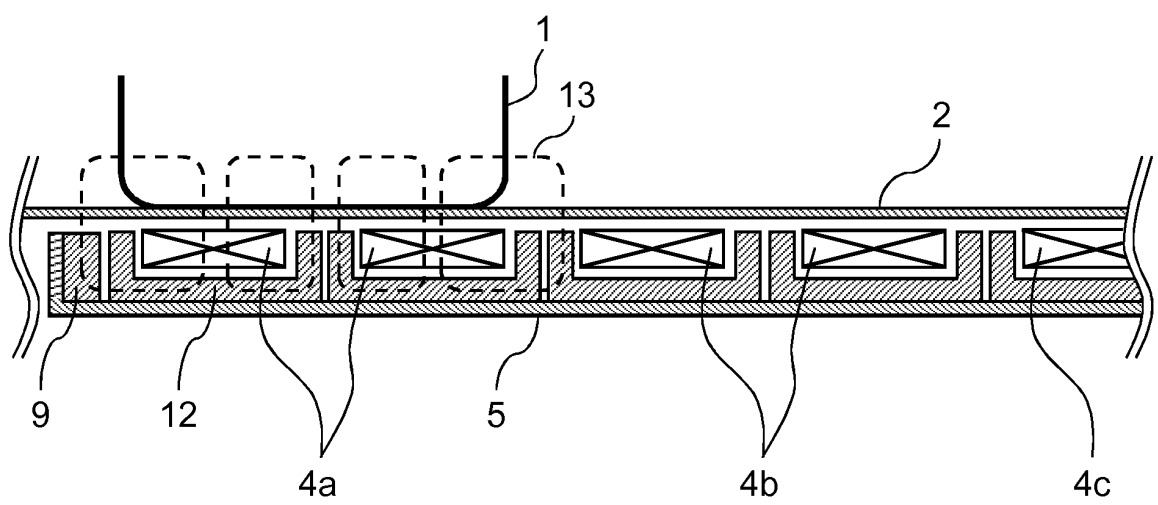


FIG. 5

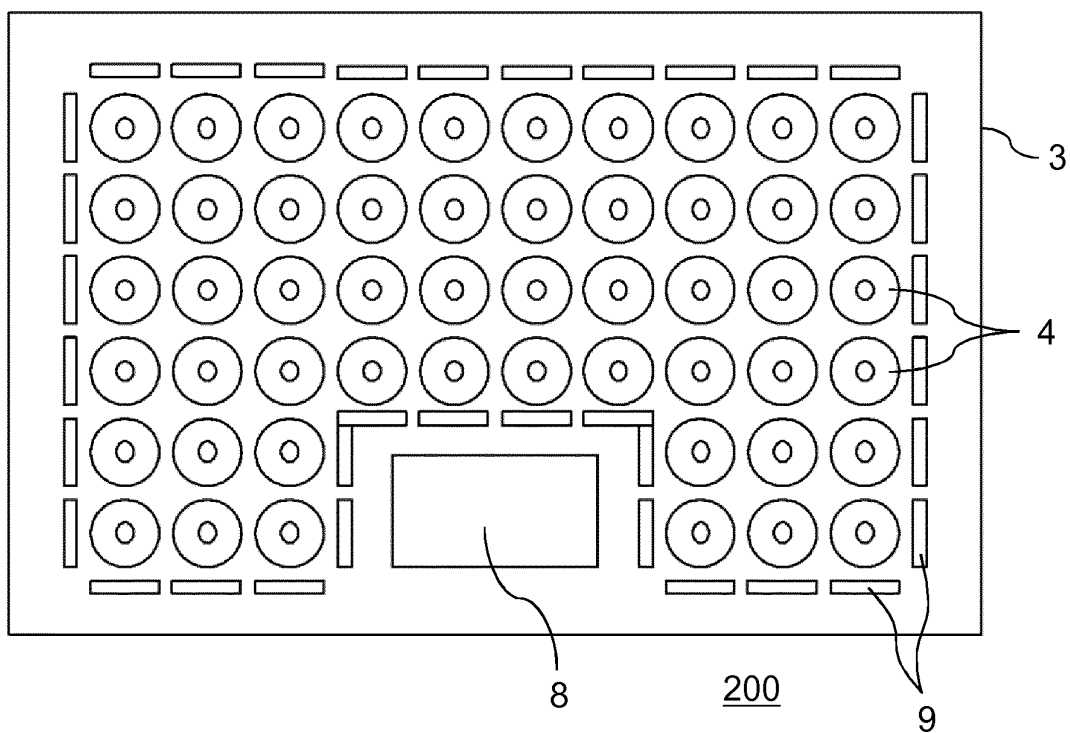


FIG. 6

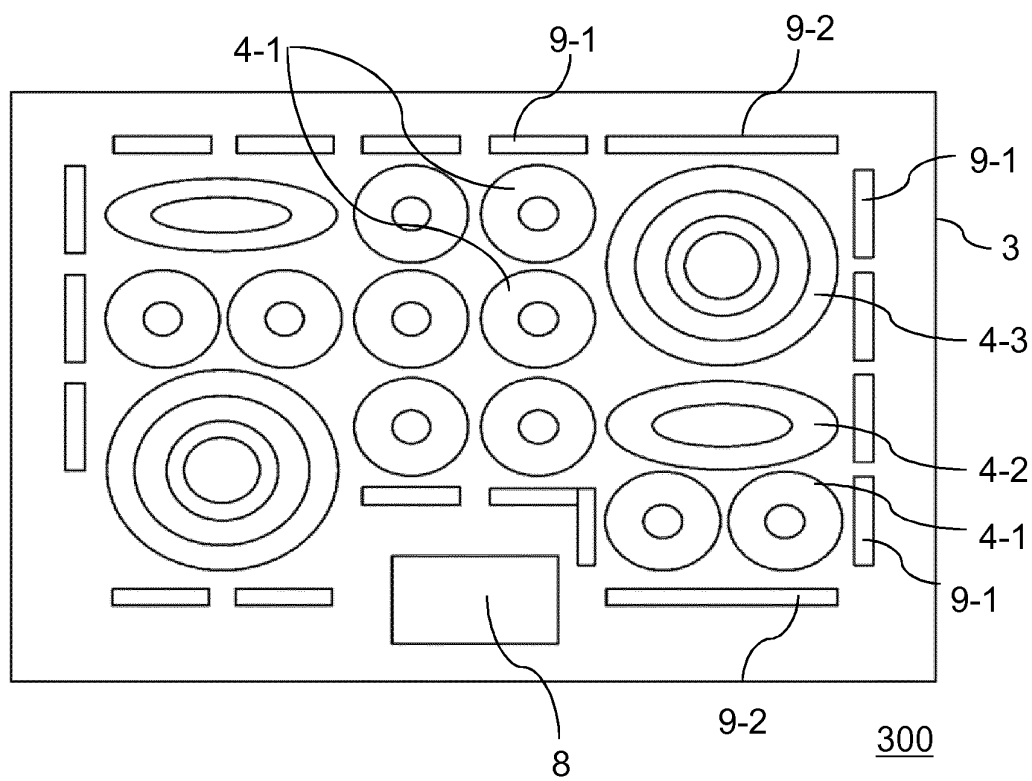
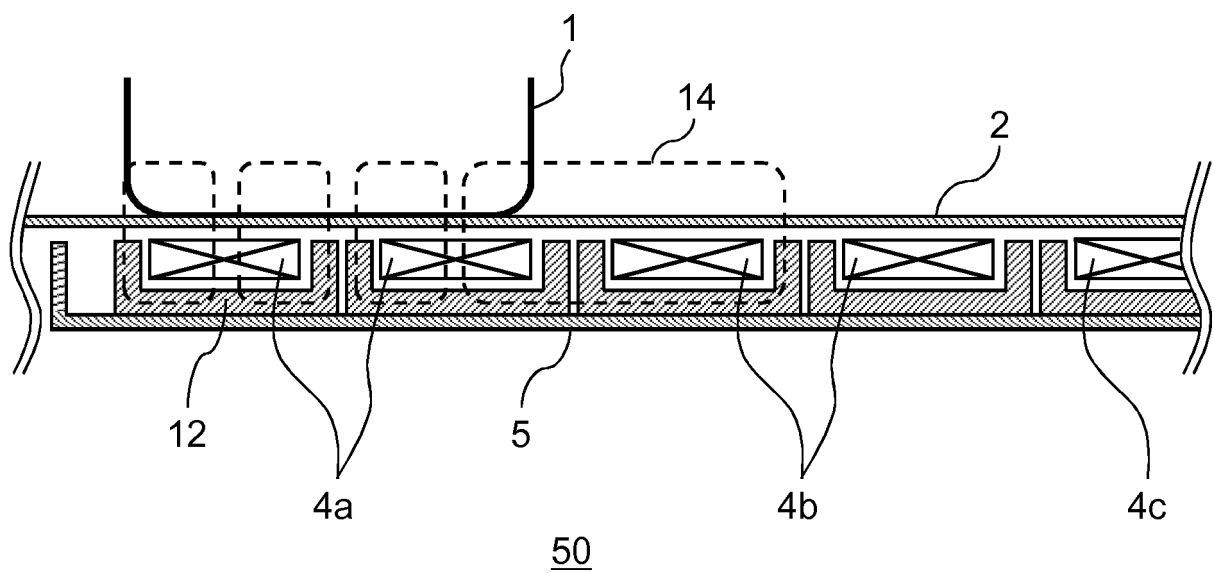


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/002139

A. CLASSIFICATION OF SUBJECT MATTER

H05B6/12(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H05B6/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013-137938 A (Panasonic Corp.), 11 July 2013 (11.07.2013), entire text; all drawings (Family: none)	1-3
A	JP 2013-080604 A (Mitsubishi Electric Corp.), 02 May 2013 (02.05.2013), entire text; all drawings (Family: none)	1-3
A	JP 2013-171708 A (Mitsubishi Electric Corp.), 02 September 2013 (02.09.2013), entire text; all drawings (Family: none)	1-3

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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Date of the actual completion of the international search
14 July 2016 (14.07.16)Date of mailing of the international search report
26 July 2016 (26.07.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/002139

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013-229346 A (Panasonic Corp.), 07 November 2013 (07.11.2013), entire text; all drawings (Family: none)	1-3

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2014044823 A [0004]